sierra monitor corporation

Model 4101-28/5100-28
IR Gas Sensor Module

APPLICABILITY & EFFECTIVITY

This manual provides instructions for the following Sierra Monitor products:

Model	Description
4101-28	IR Gas Sensor Module (4-20 mA output)
5100-28	IR Gas Sensor Module (Sentry bus output)

The instructions are effective for the above models as of October 2002

Instruction Manual Part Number T12013
Rev. B1

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1.0 Description

The IR Gas Sensor Module utilizes Infrared technology to monitor for combustible gases over the range of 0-100% LEL. The IR Gas Sensor Module requires minimal maintenance with a calibration check once a year. Internal continuous self-diagnostics will automatically indicate any fault or optics problems. The IR Gas Sensor Module has both digital signal (5100-28) and a 4-20 mA output signal (4101-28). The digital Sentry bus output signal interfaces directly to Sierra Monitor Sentry System. The 4-20 mA output signal can interface directly to the Sierra Monitor Model 4000 single controller or any standard industrial controller.

Infrared technology has the benefits of:

- Reduced need for calibration and thus lower operating costs.
- Operates in high combustible gas and/or low oxygen environment
- Works in environments where catalytic bead poisons might exist
- Rapid recovery after exposure to high concentrations of hydrocarbon gas (exceeding 100% LEL)

1.1 How It Works

Most combustible gases absorb infrared light energy at defined wavelengths, providing an absorption signature for that gas. The principle of an infrared detector is based upon the absorption of the infrared light at a specific wavelength as it passes through the gas. The more of the absorbing gas that is present, the more light is absorbed. The detector measures the energy coming from an infrared light beam at a wavelength that is absorbed by the combustible gas and compares it to the energy transmitted by the same. The difference in energy received by the detector indicates the level of combustible gas in the atmosphere.

1.2 Sensors Poisons and Inhibitors

The IR Gas Sensor Module is not affected by poisons or inhibitors that may affect Catalytic bead sensors.

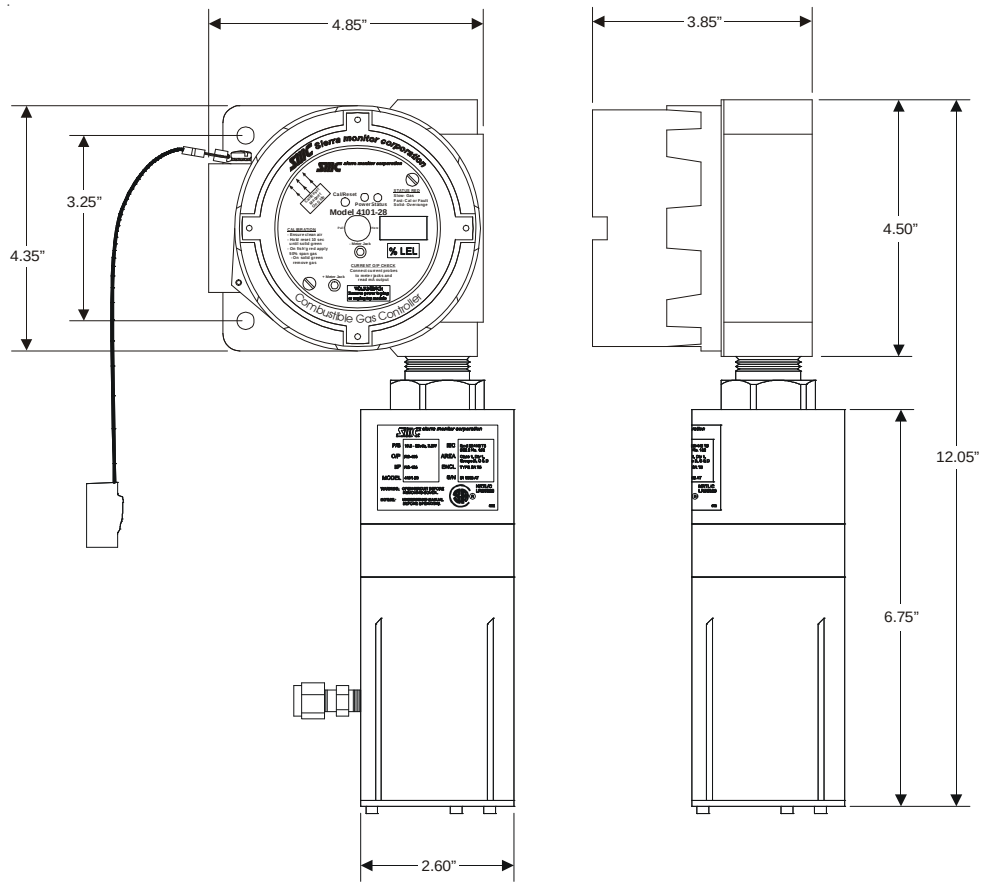


Fig. 1.0 Outline Dimensions

2.0 System Installation

2.1 Installation

2.1.1 Location of Sensors

There are no absolute rules for determining the quantity and location of gas detection heads to protect any particular facility. Locate the sensors carefully in all areas where gas escape may be expected and where it is desirable to detect the presence of unwanted gas. Use redundancy where enhanced protection or reliability is required. Light gases such as methane tend to rise while heavy gases such as propane tend to accumulate in low areas. Seek advice from experts who know the characteristics of the gas being detected, air movement patterns and the facility. Use common sense and refer to various publications that discuss general guidelines for your industry. See Application Data Sheet ADS-001 for further information.

2.1.2 Unpacking

The housing and terminal board are a single assembly to which the sensor is wired. The control module is a separate plug-in assembly. Since all modern electronic equipment can be damaged by static electricity discharge it is important to take precautions. Discharge static electricity from your body by touching a grounded metal object before handling the module. To gain access to the field terminal block remove the module carefully from the housing by grasping the centre "pull" knob and pull straight away. Field wiring is connected to the terminal strip located in the base of the housing.

2.1.3 Mounting

The housing should be oriented so that the sensor is on the under-side of the housing. Use a conduit seal and conduit loop or trap on the field wiring side to prevent water or condensation from entering the housing through the conduit or its threaded connection.

2.2 Wiring -- 4-20 mA version

2.2.1 Wiring

We recommend using shielded cable. See table below. Refer to applicable wiring codes when installing and wiring the 4101-28. After the field wiring has been carefully connected as per Fig 2.1. CHECK THAT THE CORRECT WIRES ARE CONNECTED TO THE CORRESPONDING TERMINALS AND THAT VOLTAGE LEVELS DO NOT EXCEED THE SPECIFICATIONS. When the wiring and voltages have been verified, gently plug-in the control module. Use gentle hand pressure to align and seat the module then use firm hand pressure to fully seat the module.

Wire Gauge	Maximum Length
16 AWG	2,000 ft.
14 AWG	3,500 ft.
12 AWG	6,000 ft.
10 AWG	9,000 ft.
Recommended Wire / Cable Gauge	

Table 1

2.2.2 Jumper Location for Non-Isolated / Isolated Current Output

The 4101-28 is capable of providing an isolated current output. A jumper must be moved to select between isolated, or non-isolated current output on the terminal board.

The analog output is precisely controlled by the internal micro-processor and digital-to-analog converter. The standard 4 to 20ma signal is proportional to gas concentration of 0 to 100% LEL. Additional stepped levels below 4mA provide various diagnostic signals.

2.2.3 Initial LED Status - 4-20 mA Operation

With power applied, check that the green POWER LED is ON and the FAULT/ CAL LED is showing a slow red flash during the first 90 seconds which will then change to a short green flash every 2 seconds (confidence blip). During the first 90 seconds the analog output will be at 3.0 mA and then change to 4.0mA. If after the 90 seconds warm-up the current is at 2.5mA or any value other than 4.0mA then the sensor requires calibration and the calibration procedure must be initiated. Observation of the LED status signals and output current levels aid the operator when calibrating the sensor/transmitter as described below under CALIBRATION.

The module includes an alphanumeric display that provides a variety of English language commands scrolled across the display to supplement the LED sequences and aid the operator. Please refer to the following list and see Table of Responses

2.2.4 Sensor Life

Sensor life of the module can be expected to exceed 5 years.

Sensor response may deteriorate very slowly over a period of years, depending on exposure to environmental factors. If calibration becomes impossible for any reason, the analog output will lock at 2.5mA and the status LED flashes red. Install a new 4101-28 module and recalibrate. The calibration function automatically adjusts span amplifier gain across a broad range without any need for manual adjustment of potentiometers or jumpers.

2.2.5 Test Jacks

The module is equipped with test jacks to facilitate convenient current loop measurements without opening the external current loop. To make measurements use the following procedure;

1. Attach the current meter leads to the test jacks located on the face plate.
2. Apply test gas and take meter readings. Set external controller to Bypass if necessary to avoid unwanted alarm response.
3. Remove meter leads from test jacks.

Note: The 4101-28's to 20 mA current output must be connected to a load device in order to facilitate the use of the test jacks (ie. 100 Ohm resistor must be connected between the 4 to 20 mA signal output and the common terminal if the unit is being bench tested to field installation).

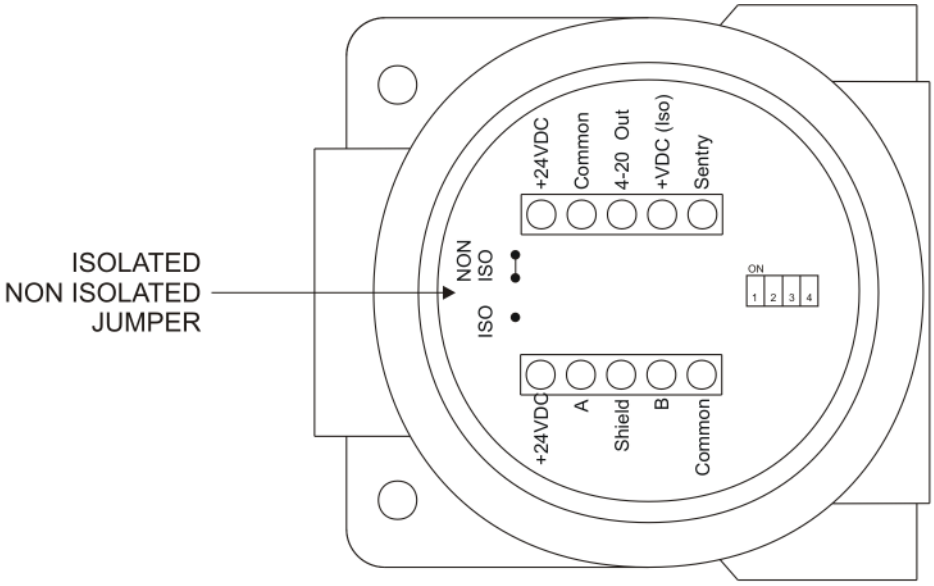
START DELAY:	power up delay in progress
SWITCH ON:	magnetic reed switch is activated
SENSOR FAULT:	fault present, sensor or sensor wiring table
SETTING ZERO:	calibration zero gas setting in progress
APPLY 50%:	apply 50% of span calibration gas
SETTING SPAN:	span gas detected, automatic span setting in progress
GAS:	remove calibration gas
FAIL CAL:	calibration span setting failed
TIME-OUT:	calibration failed, no gas detected in calibration
SENSOR FAIL:	sensor or sensor connections failed
NEG DRIFT:	excessive negative sensor drift

Table 2: Messages

CONDITION	CURRENT OUPUT (mA)	LED RED STATUS	LED GREEN STATUS	ALPHANUMERIC
Start-up delay	3	Slow Flash		Start Delay
Excess drift (>10%)	2.5	Blip/blink		NEG DRIFT
Auto Zero set	3		Solid	SETTING ZERO
Apply calibration gas	3.3	Fast Flash		Apply 50% LEL
Span is set, remove gas	3.6		Solid	REMOVE GAS
Return to normal operation	3.6		Solid	CAL COMPLETE
Normal	4		Blip/blink	0.00%
Gas Present	4.4 – 20.0	Blip/Blink		1.0% TO 99% LEL

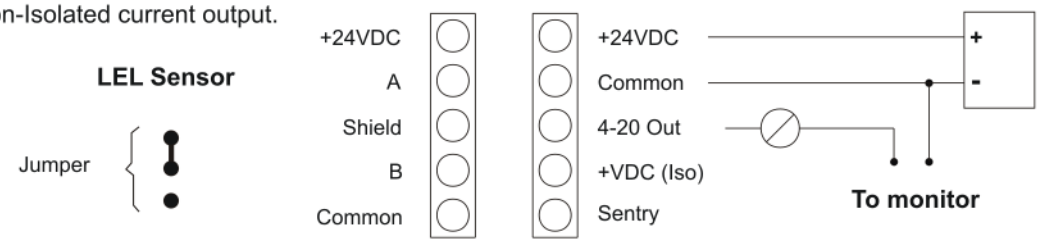
Table 3: LED Status

OVERVIEW:



TERMINAL ARRANGEMENTS:

4-20 mA Non-Isolated current output.



TERMINAL CONNECTION DIAGRAM

4-20mA Isolated current Output

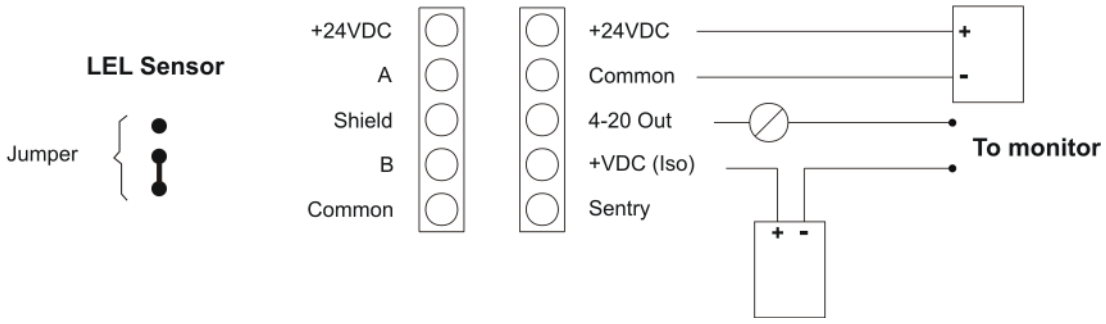


Figure 2.0: Wiring Connections & Settings

2.3 Wiring and System Installation - Model 5000 Application

Refer to Sentry Gas Monitoring System, Ver. 6.0 Instruction Manual.

2.3.1 Wiring

Caution: To access the wiring connections on the 5100-28, you will need to remove the enclosure cover and then remove the cover plate. To remove the cover plate, pull gently using the knob in the center of the board.

1. See Table 1 for wire gauge recommendations.

2. Connect P (1) from Sentry channel to the terminal at the right hand side which is labelled 24VDC (position #1).

3. Connect G (3) from Sentry channel to the terminal at the right hand side which is labelled COMMON(position #2).

4. Connect S (2) from Sentry channel to the terminal at the right hand side which is label Sentry (position # 5).

5. Set the dip switch on each module to indicate the module number. Each of the modules connected to one controller must have a different address.

Module	Switch Positions		
#	1	2	3
1	ON	ON	ON
2	OFF	ON	ON
3	ON	OFF	ON
4	OFF	OFF	ON
5	ON	ON	OFF
6	OFF	ON	OFF
7	ON	OFF	OFF
8	OFF	OFF	OFF

Note: Switch position 4 is not used

6. When the wiring , module number, and the voltage have been verified, gently plug in the control module.

7. The display will show **Start delay Model 5100-28 Sierra Monitor**.

8. Verify Sentry recognizes the desired module.

9. Calibrate 5100-28 gas sensor module.

3.0 Calibration

3.1 Overview

All applications require an initial calibration upon power up and before putting the modules into service. This initial calibration is considered a local calibration, begun and completed at the module. In the Sentry applications, the initial local calibration is to be followed up with a global calibration at the controller. (See Chapter 5 in the Sentry manual, T121001). In the 4-20mA applications a system calibration undertake at the control device may be necessary.

During the local calibration, the module output is clamped to prevent the control devices from interpreting the calibration gas as an alarm even.

System response should be checked every 6-9 months and the modules should be recalibrated as necessary or at least every year.

3.2 Local Calibration Procedure

You will need the following items to complete calibration:

- 1260-01: Cylinder of Air if none concentration of gas in background is greater than zero
- 1260-02: Cylinder of 50% LEL Methane balance air or 1256-28: Cylinder of 50% LEL Propane balance air.
- 1256-04: 2LPM flow Regulator.
- 1255-02: Gas Calibration Tubing, PTFE or equal 1/4 OD
- 1250-04: Calibration Kit is a case for storage of 2 cylinders and contains the tubing and regulator

3.3 Start Calibration

1. Deliver air if necessary for 2 minutes at 2LPM. Remove at step noted below.
2. Place and hold curved side of the magnet attached to the module at the 10:00 position on the module to commence calibration. The display will indicate the "Switch is on" followed by "Setting Zero". The status LEDs goes from slow pulsing green to steady green.
3. Remove magnet.
4. Remove air.
5. The status LED will go green indicating span gas may be applied.
6. Follow the prompts on the display;
7. Deliver calibration gas for 3 minutes at 2LPM.
8. Remove the gas after 3 minutes or when prompted.
9. The status LED will go to green indication calibration was successful.
10. When the concentration of calibration gas falls to approximately 12% LEL the module will come out of the calibration mode and be in normal operation.
11. The status LED will return to its normal pulse rate.
12. Perform a system calibration.
13. Follow chapter 5 in the Sentry manual or follow the owners manual of the control device.

Construction: **5100-28 Sentry Display Bus**

Dimensions:	13.5 x 4.75 x 4.2 inches
(HxWxD)	(34.3 x 12.1 x 10.7 cm)
Weight:	5 lb. (2.2 Kg)
Housing:	Explosion proof, Class 1, Div. I, Groups B, C, D
Appovals	CSA Class 1, DIN I, Groups B, C, D NRTL/C
Warranty:	2 years

(Specifications subject to change without notice)

4.0 Specifications:

Sensor type:

Infrared

Performance

Range:	0-100% LEL methane or propane (Other Hydrocarbons on request)
Repeatability:	+/-2% LEL
Linearity:	+/- 3% LEL
Zero Drift:	< 1% per month
Response time:	30 sec to 90% Full Scale
Accuracy:	+ 3% LEL up to 50% LEL, + 5% LEL above 50% LEL
Sensor Life:	Typically >5 years (for use at standard temperature & pressure)

Operating Range:

Ambient Temperature Range:	-40o to 167oF (-40o to 75oC)
Relative Humidity:	5-99%

Electrical Data:

Power consumption:	3.0 watts nominal, 5.0 watts maximum
Loop type:	3 wire
Loop resistance:	800 Ohms @

5.0 Limited Warranty

SIERRA MONITOR CORPORATION warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. SMC will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by SMC personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without SMC approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables (ie. calibration gases, batteries, sensors), nor to any damage resulting from battery leakage.

In all cases SMC's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above, SMC disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of SMC for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the product.